

# PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### Machine for Shearing or Forming Sheet Metal Work

I, OLOF CARDELL, of Kungsvägen 13, Sollentuna, Sweden, a subject of the King of Sweden, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a machine for shearing or forming sheet metal work, with a frame having an upper jaw and a lower jaw and carrying a mechanism for converting the rotary motion delivered by a motor into reciprocating motion.

According to the invention the mechanism comprises a driver having cam surfaces movable generally transversely between a holder for a reciprocating tool of the machine and an abutment for reciprocating said holder, and an eccentric actuating said driver, the motor driving the eccentric by a transmission and an intermediate shaft, the latter being adjustable transversely of the path of reciprocation of the tool holder for varying the reciprocatory motion of the tool.

Other features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a perspective view of a shearing machine in which the present invention is embodied.

Figure 2 is an enlarged side elevation of the shearing tools and mechanism for actuating and adjusting the same with parts in section.

Figure 3 is a fragmentary front elevation of the shearing machine illustrated in Figure 1.

Figure 4 is a fragmentary under plan view of the lower tool support structure.

Figure 5 is a fragmentary plan view of the upper tool support structure with parts in section.

Figure 6 is an exploded view of an automatically variable eccentric drive mechanism.

Figure 7 is a transverse section through the eccentric drive mechanism in assembled relation.

Figure 8 is an enlarged side elevation of a pair of beading tools which may be used in the machine.

Figure 9 is a front elevation of the tool shown in Figure 8.

Figure 10 is a vertical section, showing a further modified mechanism for converting rotary to reciprocatory motion.

Referring first to the machine illustrated in Figures 1-5, there is shown a heavy supporting frame 10 which may be a casting or which may be fabricated from plates or the like. The frame 10 comprises a lower jaw member 11 and an upper jaw member 12, the jaws providing a relatively deep open ended space therebetween as indicated at 13 for the reception of sheet material being sheared or otherwise treated in the machine.

The lower jaw 11 is provided with a relatively deep cylindrical opening providing a sleeve 15 in which is received a cylindrical tool or fixture supporting bar 16. The outer end of the sleeve 15 which is secured to or is integral with the lower jaw 11, is slotted as indicated at 17 and clamping screws 19 are provided for causing the sleeve to grip the bar 16 in its adjusted position. The end of the bar which projects outwardly beyond the sleeve or recess 15 is provided with a transverse round opening 18 for the reception of a tool or fixture support 20. As indicated in Figure 2, the opening 18 is shaped to provide a supporting shoulder 22 and the support 20 has a corresponding enlarged upper portion 23 which rests upon the shoulder 22. The outer end of the bar 16 is provided with a slot 25 to permit clamping of the support 20 by means of a clamping bolt indicated at 26 in Figure 3.

In the particular embodiment of the invention illustrated in these Figures, the machine is provided with a lower shearing tool 28 and an upper shearing tool 30. The shearing tool 28 is retained in the tool support 20 by a set screw 32 and it may be vertically adjusted by an adjusting screw 33 provided with a lock

nut 35. It will be observed that the tool support 20 extends both above and below the protruding end of the bar 16 and in order to prevent rotation of the bar 16 in its recess 15; the lower jaw 11 is provided with a pair of forwardly extending fingers 34 and 36 adapted to engage that portion of the support 20 which extends below the protruding end of the bar 16. If desired, the fingers 34 and 36 may also prevent rotation of the support 20 in the transverse opening 18; and for this purpose the sides of the support 20 opposite the fingers 34 and 36 may be flattened to co-operate with the fingers as indicated in construction lines at 38 in Figures 2 and 3.

The present machine may operate as a metal shearing machine in which case the relative position of the tools 28 and 30 is preferably as indicated in Figures 2 and 3. With the shearing machine it may in some instances, be desirable to have the lower shearing tool 28 located at the opposite side of the tool 30 from the position shown in Figure 2. Also, the machine is adaptable to perform other operations such for example as beading in which case it is desirable for the tool holders to be located in axial alignment. Simplified means are provided for adjusting the support bar 16 so as to effect the desired adjustments of the tool support 20 relative to the upper tool support. This means is best illustrated in Figures 2 and 4 and comprises a plurality of transverse slots 40, 41, and 42 provided in the support bar 16. A retaining and adjusting pin 44 is provided which extends through a cylindrical bore 46 provided in the side of the jaw 11. The intermediate portion of the pin 44 is reduced as indicated at 48 and the pin 44 is retained in the position shown in Figure 4 by a spring finger 50 mounted for pivotal movement about a retaining screw 52. The portion 54 of the pin 44 which is received within the cylindrical opening 46 is itself cylindrical and fits snugly therein. At its inner end the pin 44 is provided with a finger 56 which is eccentric with respect to the portion 54. The outer end of the pin 44 is provided with a finger piece 58 for rotating the pin and thus effecting fine adjustment in longitudinal location of the supporting bar 16. It will be understood that the several transverse grooves 40, 41, and 42 correspond to three positions of the lower tool support fixture 20.

The upper jaw 12 supports the mechanism for adjusting and driving the upper tool support 60. For this purpose the upper tool support 60 is mounted for vertical reciprocation in a bearing 62. Adjacent its lower end the upper tool support 60 is provided with a cross pin 64 to the outer ends of which are secured tension springs 66 and 68 urging the upper tool support 60 in an upward direction. The upper tool supporting head 70 is provided with a pair of downwardly extending guid-

ing fingers 72 and 74 between which one end of the pin 64 is slidable. This prevents rotation of the tool support 60 and guides it during its reciprocating movement.

The drive means for the reciprocating tool support 60 comprises a driver 80 having an eccentric drive member 82 connected to one end thereof and actuated by a driving motor 84. At its opposite end the driver 80 is provided with a pair of oppositely disposed concave surfaces 86 and 88. The upper end of the tool support 60 is provided with an upwardly facing concave surface 90. Located above the free end of the driver 80 is an adjustable abutment 92, the lower end of which is provided with a downwardly facing concave surface 94. Located between the co-operating concave surfaces 86 and 90 is a roller 96 which may be in the form of a ball or cylinder depending upon the shape of the concave surfaces. A similar roller 98 is provided between the concave surfaces 88 and 94. With the adjustable abutment 92 in stationary position, actuation of the driver 80 by the eccentric 82 will result in transverse movement of the concave surfaces 86 and 88 across the corresponding ends of the tool support 60 and the abutment 92. The concave surfaces engaging the rollers 96 and 98 are designed so as to cause rolling motion of the rollers to take place in accordance with the transverse motion of the free end of the driver 80. The effect of this is a camming action which will move the tool support 60 downwardly as the free end of the driver 80 moves in either direction from the intermediate position illustrated in Figure 2. Accordingly each rotation of the eccentric 82 will result in two complete vertical reciprocations of the upper tool support 60.

Means are provided for shifting the adjustable abutment 92 into any one of three predetermined positions. This means takes the form of a cam 100 having an actuating handle 102 secured thereto. As best seen in Figure 3 the cam is provided with a plurality of camming surfaces 103, 104, and 105 which correspond to three different positions of adjustment of the abutment 92. The operating handle 102 as best seen in Figures 2 and 3, extends through a slot 106 provided at the top of the tool head 70 and in the cap 108 provided at its upper end. As indicated in Figure 3 the cam surface 103 determines the uppermost position of the abutment 92. Cam surface 104 determines an intermediate position of the abutment 92. Cam surface 105 determines the lowermost position of the abutment 92.

When the machine is employed as a metal shearing machine with tools of the type illustrated at 28 and 30, the shearing is accomplished when the range of reciprocation of the upper shearing tool 30 is such that at its lower limit it substantially meets but does not pass below

the upper portion of the tool 28. However, if it is desired to initiate a cut at an intermediate point in sheet metal or other material this can be accomplished by causing a shift in the range of reciprocation of the upper tool downwardly so that in its lowermost position the lower end of the upper tool 30 passes substantially below the upper end of the lower tool 28. This greatly improves the flexibility of the machine and completely avoids the necessity of providing a drilled hole where it is desired to initiate a cut at a point within the edge of sheet material.

From the foregoing it will be appreciated that with the handle 102 in the position illustrated, the upper tool 30 occupies an upper range of reciprocation sufficiently above the lower tool 28 to permit passage of sheet metal between the cutting tools without contact therewith. If the handle 102 is swung so as to bring the camming surface 104 into engagement with the upper surface of the abutment 92, the range of reciprocation of the upper tool 30 is moved downwardly to a position in which the shearing operation takes place. If the handle 102 is swung further so that the cam surface 105 engages the upper surface of the abutment 92, the abutment is moved downwardly to shift the range of reciprocation of the upper tool 30 downwardly so that it passes beneath the upper portion of the lower tool 28 and is thus effective to puncture sheet metal preparatory to initiating a cut at a point located within the edge thereof.

The upper head 70 is provided with a roller support 110 carrying a work engaging roller 112. Also located at a point between the jaws 11 and 12 is a work support device 114 which is preferably adjustable longitudinally of the jaws. The details of this support form no part of the present invention but it may be pointed out that it constitutes a pivot support by means of which sheet material may be cut to a circular configuration with a radius dependent upon the spacing between the work support 114 and the operating points of the shearing tools 28 and 30.

With the camming surfaces 86, 88, 90, and 94 disposed as illustrated in Figure 2 and with the driver 80 in mid-position of its transverse movement, it will be appreciated that a single rotation of the eccentric 82 results in two complete up and down strokes of the tool support 60. If however, the driver 80 is shifted longitudinally so that the entire transverse stroke thereof results in movement of the rollers 96 and 98 to one side only of the low portions of the camming surfaces, it will be appreciated that a complete rotation of the eccentric 82 will result in a single up and down reciprocation of the tool support 60.

In order to accomplish this result a shaft 120 driven by the motor 84 may be mounted in bearings adjustable on guide ways 115

(Fig. 2), and adjustment of the shaft results in corresponding shifting of the driver 80 connected thereto.

A second adjustment in the driving relation is possible by varying the effective eccentricity of the drive mechanism for the driver 80. In accordance with the present invention and as best illustrated in Figures 6 and 7, there is provided an automatically operable mechanism for changing the effective eccentricity and hence the length of stroke of the driver which is operated automatically in response to a reversal of the driving motor 84.

This mechanism comprises the shaft 120 which is provided with a driving key 122. Sleeved over the shaft 120 is a first eccentric member 124 having a keyway 126 therein for the reception of the key 122. At one end of the eccentric member 124 is a transversely extending driving dog 128 which preferably is formed integrally with the eccentric member 124. A second eccentric member 130 is provided which has a smooth internal bore 132 adapted to fit smoothly over the exterior cylindrical surface of the eccentric member 124. At one end the eccentric member 130 is cut away as indicated at 134 to provide a pair of driving shoulders 136 and 138. When the parts illustrated in Figure 6 are assembled as illustrated in Figure 7, the dog 128 engages one of the shoulders 136 or 138 depending upon the direction of rotation of the shaft 120. The eccentricity of the eccentric members 124 and 130 are so located relative to the location of the driving dog 128 and the shoulders 136 and 138 that in limiting position, the effective eccentricity of the assembly is equal to the sum or the difference of the individual eccentricities of the eccentric members 124 and 130. It will be appreciated that the change from one effective eccentricity to the other is accomplished simply by reversal of the motor.

Fig. 10 illustrates a modified embodiment of the means for shifting the driver 80. The driver is mounted by roller bearings 121 on the eccentric 123 keyed to the shaft 120 which is driven from the motor 80 by way of a belt transmission (not shown). The shaft 120 is carried by suitable bearings in one arm of a double-armed angular lever 125 suspended from a bolt 127 carried by the frame. The other arm of the lever 125 is journaled on a shaft 131 located eccentrically on a bearing disk or sleeve 129 rotatably mounted in the frame. It would be apparent that adjustment of the disk or sleeve 129 by turning it in one or the other direction results in a displacement of the driver 80 (to the left or the right in Fig. 10). Such adjustment could require adjustment of the tension in the belt transmission between the motor 80 and the shaft, and to accomplish this the motor is mounted on a support 133 hinged on a bolt at one edge and carried by a set screw 135 at the opposite edge. Screwing down the set screw

results in a tightening of the belt and screwing upward causes relaxation thereof.

Referring now to Figures 8. and 9 there is illustrated by way of example, another set of tools which may be substituted for the tools 28 and 30 illustrated in the foregoing Figures. In this case upper and lower beading tools 140 and 142 are provided. These tools may be supported in the same tool supports 60 and 20 previously described. The lower beading tool is provided at its upper surface with a rounded groove or channel 144 and the upper beading tool 140 is provided at its lower surface with a downwardly extending rib 146. As best illustrated in Figure 9 the rib 146 is tapered at one end as indicated at 148. It will be appreciated that the tools 140 and 142 are adapted to co-operate when operated in vertical axial alignment and accordingly when tools of this type are substituted for the shearing tools illustrated in Figure 2, the supporting bar 16 will be positioned in the recess 15 so that its intermediate groove 41 is in registry with the fingers 56 of the adjusting pin 44.

The drawings and the foregoing specification constitute a description of the improved shearing or forming machine in such full, clear concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim is:—

1. A machine for shearing or forming sheet metal work, with a frame having an upper jaw and a lower jaw and carrying a mechanism for converting the rotary motion delivered by a motor into reciprocatory motion, in which the mechanism comprises a driver having cam surfaces movable generally transversely between a holder for a reciprocating tool of the machine and an abutment for reciprocating said holder, and an eccentric actuating said driver, the motor driving the eccentric by a transmission and an intermediate shaft, the latter being adjustable transversely of the path of reciprocation of the tool holder for varying the reciprocatory motion of the tool.

2. A machine as claimed in claim 1, in which the motor is mounted on the top of the upper jaw.

3. A machine as claimed in claim 1 or 2, in which rolling members are provided between the abutment and the driver and between the driver and the holder, the surfaces of said abutment, said driver and said holder, which engage said rolling members, being concave with respect thereto.

4. A machine as claimed in any of claims 1 to 3 in which the abutment is adjustable longitudinally of the path of reciprocation of the tool holder, shifting means being provided to shift the abutment toward and away from the holder against spring action, said shifting

means comprising a three position cam having cam surfaces effective to position said abutment so as to locate said holder in working position, or in idle or loading position.

5. A machine as claimed in any of claims 1 to 4, in which mounting means are provided for adjustment of the intermediate shaft, eccentric and driver as a unit toward and away from said holder so that either one or two working strokes of the tool may be obtained from a single rotation of the eccentric.

6. A machine as claimed in any of claims 1 to 5, in which the eccentric co-operates with means automatically operable upon reversal of the motor to vary the effective eccentricity of the eccentric.

7. A machine as claimed in any of claims 1 to 6, in which the eccentric comprises a rotatable eccentrically mounted part, an eccentric sleeve journaled on said part, co-operating abutments on said sleeve and part permitting limited relative rotation between said sleeve and part, said co-operating abutments being located such that the effective eccentricity of said mechanism is of two different values when said sleeve and part are in opposite limiting positions.

8. A machine as claimed in any of claims 1 to 7, in which the tool holder is mounted in the upper jaw of the frame, the lower jaw being provided with a lower tool holder mounted in a fixture support bar displaceable in an elongated sleeve which is secured to or is integral with the lower jaw.

9. A machine as claimed in claim 8, in which the fixture support bar is adjustable to accurately predetermined position wherein it is held by a pin with an eccentric finger adapted to engage one of a plurality of recesses or slots in the bar to locate said bar in a corresponding member of initial positions.

10. A machine as claimed in claim 9, in which the slots or recesses are in such a position in the fixture support bar that a tool carried by the lower tool holder occupies a shearing position at one side of the upper tool when the finger engages one of the slots or recesses, at the other side of the latter tool, when said finger engages another of the slots or recesses, and opposite the latter tool when the finger engages a slot or recess located between said slots or recesses.

11. A machine as claimed in any of claims 8 to 10, in which one end of the support bar projects from the elongated sleeve and has an opening transversely of the bar, the lower holder being mounted in said opening.

12. A machine as claimed in claim 8, including means preventing rotation of the lower tool holder in the bar comprising projections mounted on the sleeve and extending at opposite sides of the tool holder, to engage plane surface at opposite sides of the tool holder.

13. A machine as claimed in claim 1, in

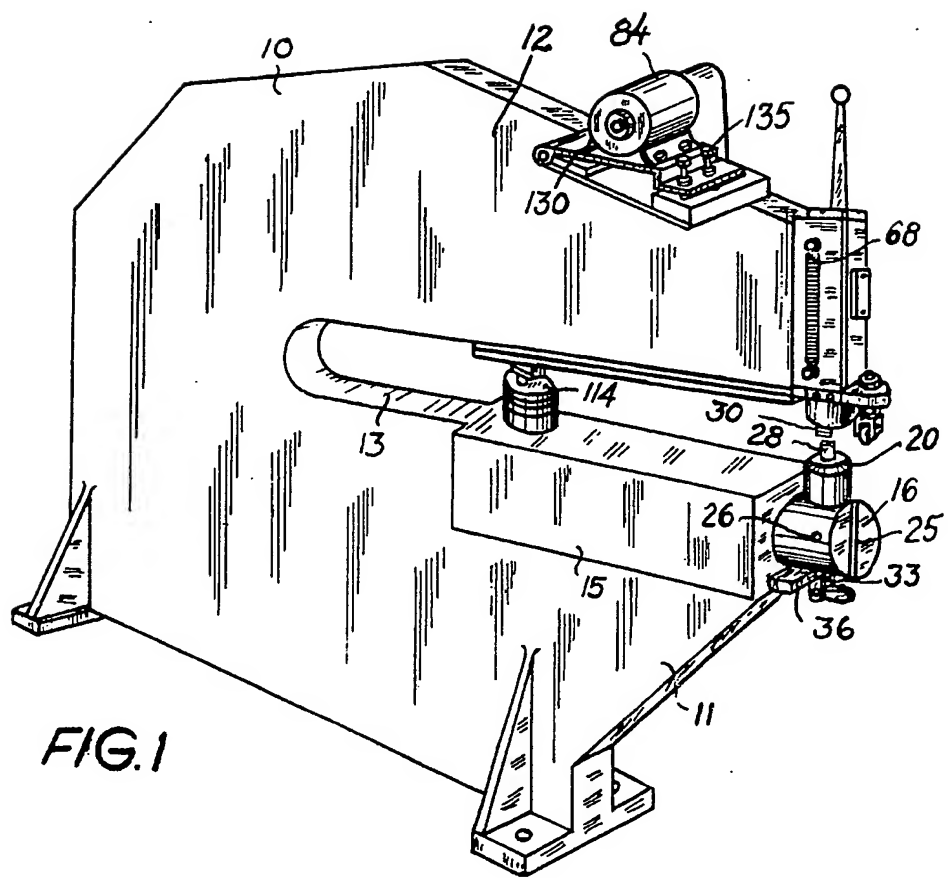
5 which the eccentric is carried by one arm of a double-armed angular lever, the other arm of which is adjustable to swing the angular lever about an axis of suspension for varying the reciprocatory motion of the tool.

14. A machine for shearing or forming sheet metal substantially as hereinbefore

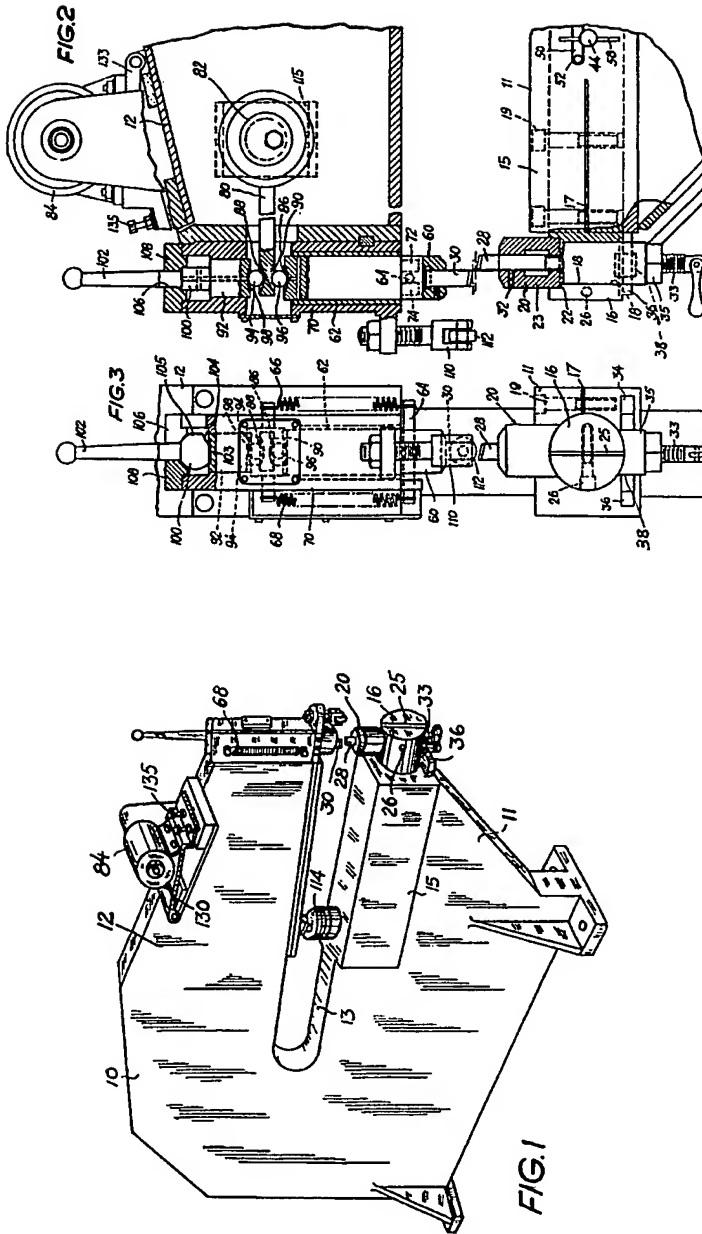
described with reference to the accompanying drawings.

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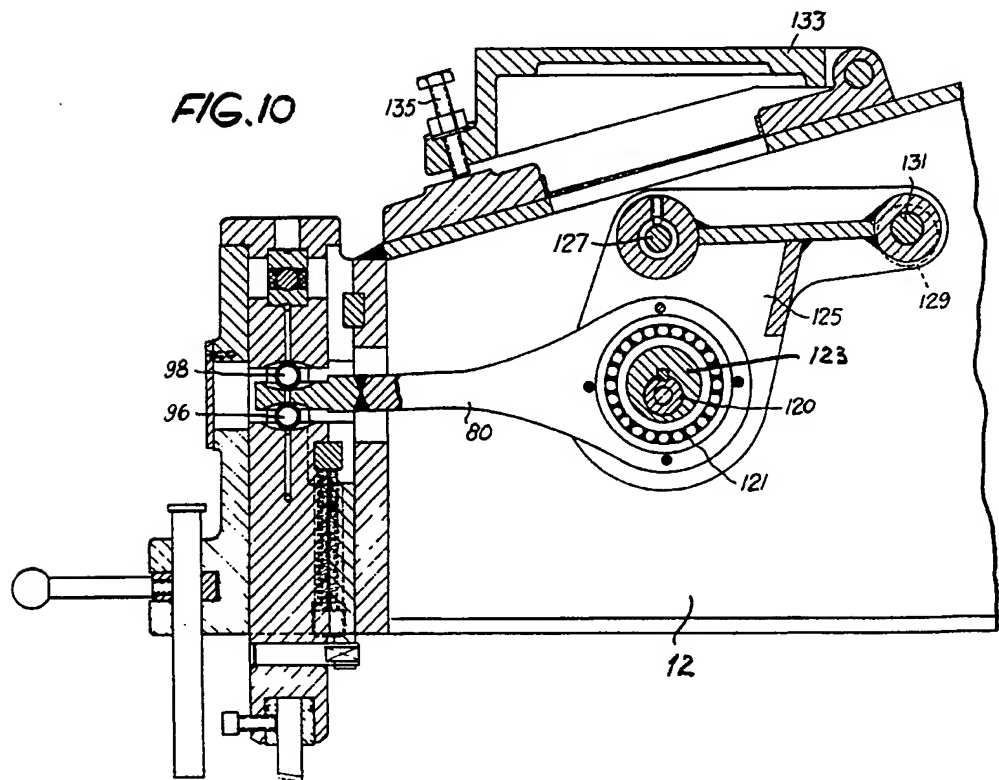
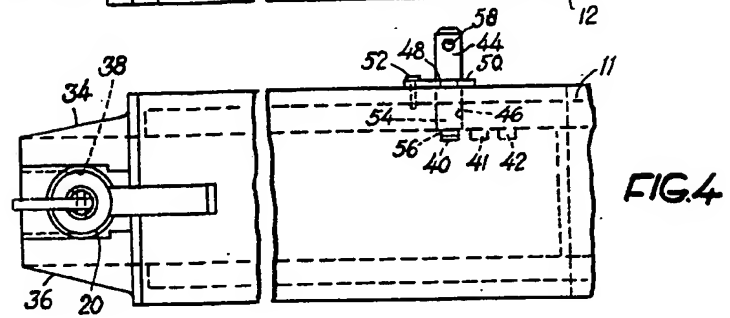
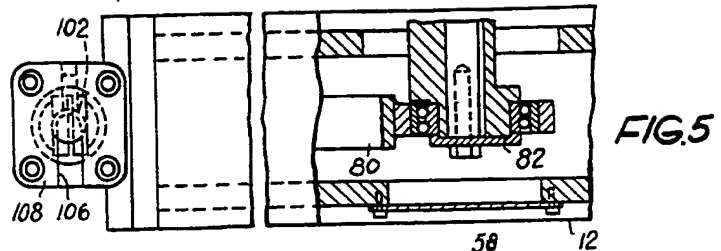
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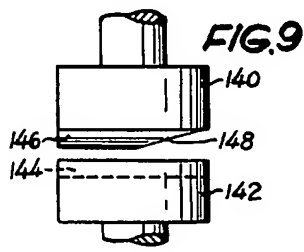
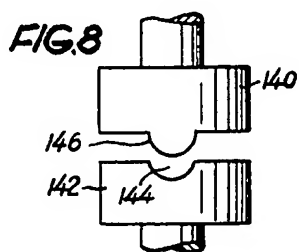
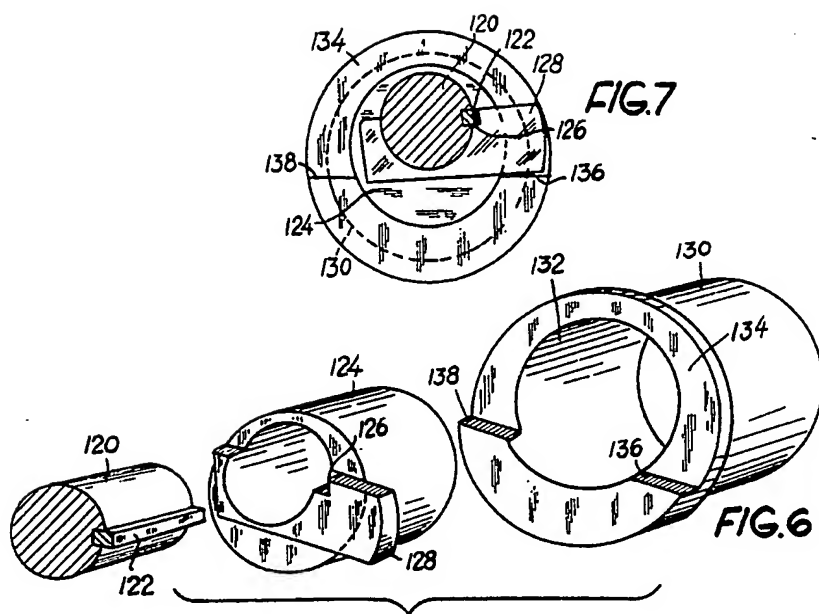
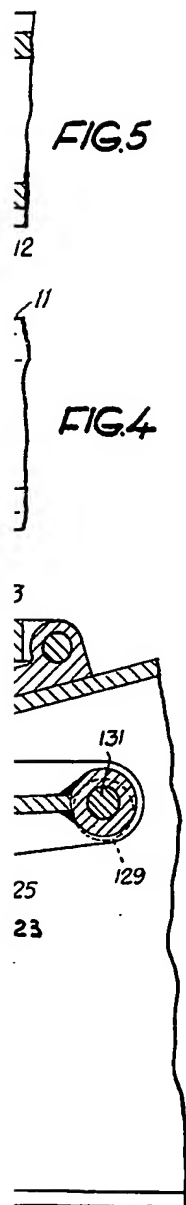












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 Sheets 3 & 4

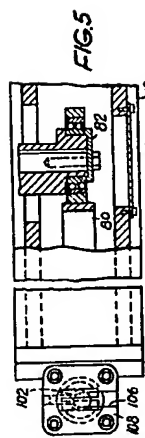


FIG. 5

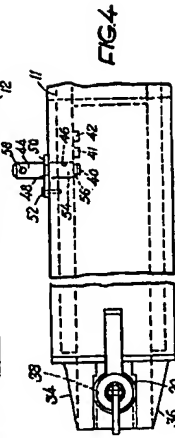


FIG. 4

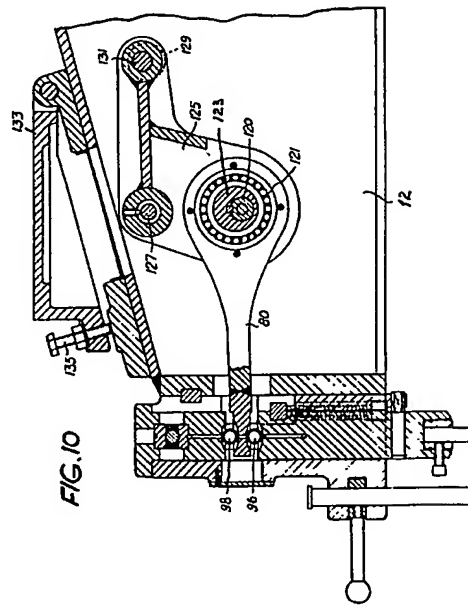


FIG. 10

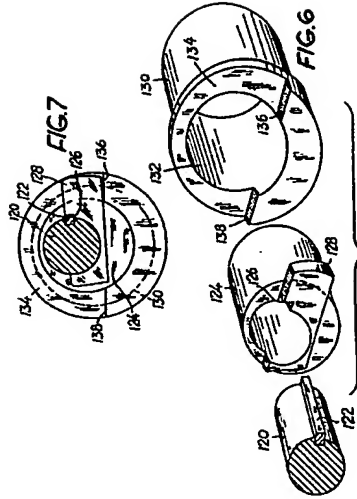


FIG. 6

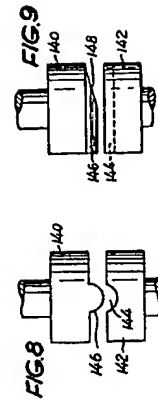


FIG. 8

